

Fisheries Monitoring Report
For The
Massachusetts 1990
Striped Bass Fisheries

Prepared for the ASMFC Striped Bass
Technical Committee - April 1991

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Introduction

This report characterizes the commercial and recreational striped bass fisheries that were conducted in Massachusetts during 1990. The information was collected from monitoring programs which are considered to be essential elements of the long-term management approach as described by Section 7 of the Atlantic States Marine Fisheries Commission's (ASMFC) Fisheries Management Report No. 15 (Supplement to the Striped Bass FMP-Amendment #4). Several sources of information have been examined to estimate harvest levels, levels of total catch (which include fish that are caught but released alive, primarily fish of sub-legal size), and catch composition (size, sex, and age). These include, Massachusetts Division of Marine Fisheries (DMF) and National Marine Fisheries Service (NMFS) based programs (Diodati, 1990).

Commercial Fishery

The 1990 commercial fishery was conducted between July 1 and September 30, 1990. The harvest cap determined by ASMFC prior to the start of the fishery, was 160,000 pounds. The fishery was conducted by hook and line only and a minimum size requirement of 36 inches total length (tl) was enforced. All those wishing to buy striped bass directly from fishermen were required to obtain a special authorization from the DMF in addition to standard seafood dealer permits. Fishermen who intended to sell their catch required both a commercial fishermen's permit and special striped bass fishing permit. Dealers were required to telephone the DMF every 2 weeks to report their striped bass purchases (in pounds), a toll-free number was supplied for this purpose. They were also required to provide a written transcript of their purchases consisting of the names of fishermen that they purchased bass from, along with their permit numbers and numbers of fish and pounds purchased. This was forwarded to the DMF within 15 days following the close of the season. Fishermen were required to file catch reports at the end of the season, which included the name of the dealer(s) they sold to as well as information describing their catch composition and catch rates. A number of fishermen voluntarily provided personal fishing diaries. The DMF's Fishery Statistics and Automated Data Processing Project developed all the necessary database applications to handle dealer and fishermen reports.

Harvest Levels

Ninety five dealers were authorized to purchase stripers during 1990. The Authorizations of 4 dealers were revoked mid-season due to non-compliance with reporting requirements. The dealer telephone survey provided the measure of harvest necessary to gauge the distance to the harvest cap, while the dealer written transactions provided the overall estimate of the commercial harvest. The latter was considered to be better, given that the telephone survey could have been prone to contain math errors or rough guesses. Final season estimates were 150,670 pounds (6,528 fish) and 147,852 pounds (6,333 fish), for the telephone and written surveys, respectively.

Somewhat consistent with the above, was a third estimate of striped bass harvest provided by fishermen reports. This level was 134,861 pounds (5,725 fish), with nearly an 83% reporting rate; 1498 permits were issued. The reporting rate for 1987-1989 averaged about 89%. Since 1990 fishermen reports are still being received, it can be expected that the final harvest estimated from this method will approach the 148,000 pounds indicated above (as the report rate reaches 89%). Past monitoring methods (1987-1989) resulted in harvest estimates from dealers and fishermen that differed by an average of 30%, fishermen consistently reported a larger harvest. Because of this reporting difference, the 1990 harvest cap, estimated as 20% of Massachusetts striped bass landings during 1972-1979 (232,000 pounds), was reduced by 30% (to 160,000 pounds) by ASMFC. Given the consistency between methods

that estimated harvest during 1990, it is expected that the harvest cap for 1991 will be reinstated to 232,000 pounds.

Catch Composition

The size composition of the catch was estimated from both dealer and fishermen reports, as well as from field sampling at dealer sites by DMF staff. Field sampling also provided information on the age and sex composition of the harvest. The method and source of information used to estimate fish size depended on the makeup of the catch. Catch disposition includes 4 categories: (1) sub-legals caught and released (2) harvested fish that were sold (3) harvested fish that were not sold (consumed) (4) legal size fish caught and released. To estimate total numbers of fish caught, the fraction of fish reported as sold on fishermen reports as compared to those reported in the dealer written transactions (0.90) was considered to be directly proportional to the total catch of fish. Therefore, estimates of numbers of fish caught by category reported in fishermen reports, were divided by 0.90 to reflect the total catch.

Personal diaries from 45 fishermen were examined to estimate the size composition of sub-legal size fish that were caught and released. Average size distributions from 312 fish provided this estimate (Table 1). Striped bass weight at size in all tables was estimated, given the expression:

$$W = aL^b \quad (1)$$

where $a = 3.714E-08$ and $b = 2.939$; W = weight in pounds and L =

length in fork length (mm). These parameters were estimated from striped bass measured in the Massachusetts commercial harvest during 1982-1985. To convert from total length to fork length, expression (2) was used (ASMFC, 1981):

$$TL = 1.038FL + 0.4662 \quad (2)$$

The size distribution of harvested fish that were sold is presented in Table 2. This distribution was estimated from 902 cases where the weight of an individual bass was reported in the written transcripts provided by dealers. Conversion to length (TL) was done using expressions (1) and (2). Fish distributed below the minimum size (36 inches) were attributed to the conversions, since sub-legal size fish were found to be virtually non-existent in actual field data. The sex composition was estimated to consist of 92% females, within the range of estimates (7%-16%) found during 1982-1985 (Diodati, 1986).

Fishermen's seasonal catch reports provided the information used to estimate the size distribution of fish harvested but not sold and legal size fish caught and released (Tables 3 and 4, respectively). The reports allowed a frequency distribution of fish by weight to be developed, from which fish at length were estimated. Tables 5 and 6 contain the aggregate information of the estimated total catch at length by numbers and pounds of fish, respectively. The largest component of the catch was the sub-legal category, consisting of 88% by number and 75% by weight. The percent frequency distribution of the total catch for numbers of fish at length is presented in Figure 1.

Recreational Fishery

The Massachusetts 1990 recreational striped bass fishery had no seasonal restrictions, nor were recreational anglers required to obtain a fishing permit. Catch was restricted to 1 fish per angler per day and a 36 inch minimum size (Tl) was maintained. Harvest levels and total catch were estimated from the NMFS MRFS. Since 1988, MRFS estimates for the Massachusetts striped bass catch (in numbers of fish) have achieved a coefficient of variance (cv) of 16 or less (Diodati, 1990). The sources of information described in the previous section, were used to characterize the size distribution of the recreational catch.

Harvest levels

The preliminary MRFS estimate for total catch in number (including fish released) is 453,309 striped bass (cv = 15.4). Fishermen catch reports (described in the previous section), were used to estimate the portion of sub-legal size fish in this catch. Only those reports that indicated no bass were sold were examined, assuming their catch composition was directly proportional to that of the recreational fishery. Of 822 fishermen reporting to have caught bass, 475 did not sell any; these reports indicated that 94.4% of the bass caught were of sub-legal size. The assumption that this fraction is proportional to the recreational fishery seems reasonable, since recreational fishing surveys conducted in Rhode Island, New York, and Connecticut waters report a similar range, 94%-97% (Crecco, pers. comm.). Therefore, the portion of

the total catch represented by sub-legal size bass, was estimated to be 427,924 fish ($453,309 \times 0.944$).

Massachusetts fishermen reported to have released 44% of the legal size bass they caught. This fraction is considerably lower than that observed from the Connecticut fishery, which averaged 74.2% between 1984-1990 (Crecco, 1990). However, Massachusetts waters have the reputation of producing trophy size stripers and historically have attracted vacationers in search of such a fish. The added time and money invested in the fishery may create a greater incentive to harvest fish here than elsewhere. The portion of the total catch estimated to have been of legal size fish caught and released, was 11,144 fish ($453,309 - 427,924 \times 0.439$). Therefore, the recreational harvest was estimated to be 14,241 fish ($453,309 - 439,068$).

The average size composition of the catch was estimated using information and techniques similar to those described in the previous section. The sub-legal portion of the recreational catch consisted of 87.6% by number and 94.4% by weight, with total weight estimated at 4,784,882 pounds (Tables 7 and 8).

Estimating Total Striped Bass Losses

Potential background mortality as a result of hook and release fishing and poaching of sub-legal striped bass was estimated in both the commercial and recreational fisheries. An investigation for bycatch related losses in several netting operations, was also conducted. They were chosen because of their proximity to well known striped bass migration routes and periods, and consist of otter trawl, purse seine, fish trap and gill net fisheries. This section is based on a similar work conducted by Crecco (1990) in Connecticut and utilizes the same formulas, factors and notations he describes to calculate the total non-harvest mortality rate (T) from hook-release (h) and poaching (p) on sub-legal size fish. Neither direct or direct estimators of background mortality as a result of illegal commercial fishing operations (primarily netting) were available when this report was drafted.

Striped Bass Commercial Fishery

Sub-legal losses attributed to hook-release mortality and poaching have been estimated using a hook-release mortality rate (h) of 0.175 (Diodati, 1990) and a poaching mortality rate (p) of 0.035. Poaching mortality in the commercial fishery has not been measured, it is an assumed value. Crecco (1990), estimated (p) in the Connecticut recreational striped bass fishery to be 0.14. It was an assumption that commercial striped bass fishermen would be less prone to poach than a recreational fishermen. An enhanced awareness of the resource and it's problems was anticipated for

this group, given that they were required to purchase fishing permits, file catch reports, and were provided with regulations for the fishery. Accordingly, (p) was substantially reduced (by 75%) for the commercial sector. The conditional rate of total non-harvest mortality (T) was expressed as:

$$T = h + p - (h \cdot p) = 0.20 \quad (3)$$

Other sources of mortality include hook-release on legal size fish. From Table 5, direct losses totaled 8,465 fish (harvest sold and not sold). Sub-legal losses to hook-release and poaching were 14,613 fish ($71,674 \times 0.20$). Losses to hook-release of legal size fish were 229 ($1,309 \times 0.175$). Total losses attributed to this fishery were therefore estimated at 23,307 striped bass; over 60% was assigned to hook-release and poaching of sub-legal size fish (Table 9). The equivalent weight of total losses was estimated at 356,111 pounds (Table 10).

Striped Bass Recreational Fishery

Losses in this fishery were primarily due to hook-release ($p = 0.175$) and poaching ($p = 0.14$). From Table 7, direct losses due to harvest, totaled 14,241 fish. Sub-legal losses to hook-release and poaching (where $T = 0.29$) were 124,098 fish ($427,924 \times 0.29$), and losses due to hook-release on legal size fish were 1,950 ($11,144 \times 0.175$). Therefore, total losses in the recreational fishery were 140,289 striped bass (Table 11). The estimated total loss of striped bass in weight was 1,609,093 pounds (Table 12).

Other Fishery Bycatch

Although fishing with nets is generally prohibited in the Commonwealth's inshore areas, permits are occasionally issued for certain target species, gear types and fishing areas. As a condition of such permits fishermen must file detailed reports of their fishing activities and catch. A review of annual reports prepared by the DMF Statistical and Data Processing Project between 1987-1990, indicate none of these fisheries reported striped bass as bycatch.

A fishing venture for loligo squid developed in the near-shore waters of Nantucket Sound during the spring of 1989 and 1990. The DMF closely monitored this operation, mandating at-sea observers be a condition of the permits. During 1989, 2,700 sublegal stripers were estimated to have been lost (Diodati, 1990). Although the fishery was allowed to continue in 1990, low availability of squid gave rise to a shortened season and striped bass catch was reported to be substantially less (McKiernan, pers. comm.), thus, no striped bass bycatch for 1990 was estimated in this report.

Several suspect fisheries, those with potential to result in high bycatch of striped bass or other highly regulated species, have developed over the years, but once identified the DMF has prohibited or heavily regulated their operation. Seasonal and areal closures to gillnetting, particularly during springtime south of Cape Cod, have been established chiefly to protect migratory stocks of juvenile striped bass.

Conclusions

During 1990, total losses in the recreational fishery outweighed those in the commercial fishery by 6 to 1 in number of fish, and by nearly 5 to 1 in weight of fish (Tables 9-12). Combined losses of striped bass were estimated at 163,600 fish, with an equivalent weight of 1,957,900 pounds (Table 13). Most of this mortality was attributed to hook-release (50%) and poaching (35%). The parameters chosen to estimate hook-release (0.175) and poaching (0.14 in the recreational fishery and 0.035 in the commercial fishery) may have been liberal, and thus, would have overestimated these losses. For instance, there is some basis for applying lower rates of hooking mortality (0.08 rather than 0.175) (Diodati, 1990). If the lower rate of (h) was used, then the total losses in Table 13 would have been reduced by 26% in number (to 121,100 fish) and by 22% in weight (to 1,536,200 pounds). This study may have overestimated the weight of the striped bass catch in the recreational fishery as well, since the size distribution of sub-legal size fish caught by recreational fishermen was assumed to be comparable to what was observed in the reports of fishermen licensed to fish commercially.

All sources of bycatch mortality, or mortality attributed to illegal fishing practices, have not been enumerated by this study. However, there is no evidence to suggest that the missing elements will far outweigh any values listed in Table 13. DMF regulatory procedures appear to blanket the potential for high bycatch rates to occur.

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Table 1.

Size distribution of sublegal striped bass caught and released during the 1990 Massachusetts fishery. Based on fishermen daily catch logs.

*TI (in.)	Sample	Total	%	Cumm. %	Wt. (lbs.)	%	Cumm. %
15	0	0	0.0	0.0	0	0.0	0.0
16	3	689	1.0	1.0	1,071	0.1	0.1
17	1	230	0.3	1.3	427	0.1	0.2
18	1	230	0.3	1.6	504	0.1	0.3
19	1	230	0.3	1.9	591	0.1	0.4
20	6	1,378	1.9	3.8	4,124	0.6	0.9
21	1	230	0.3	4.2	793	0.1	1.0
22	8	1,838	2.6	6.7	7,275	1.0	2.0
23	7	1,608	2.2	9.0	7,253	1.0	3.0
24	11	2,527	3.5	12.5	12,915	1.8	4.7
25	6	1,378	1.9	14.4	7,942	1.1	5.8
26	14	3,216	4.5	18.9	20,793	2.8	8.6
27	15	3,446	4.8	23.7	24,890	3.4	12.0
28	29	6,662	9.3	33.0	53,544	7.3	19.3
29	10	2,297	3.2	36.2	20,468	2.8	22.1
30	29	6,662	9.3	45.5	65,572	8.9	31.0
31	24	5,513	7.7	53.2	59,753	8.1	39.1
32	43	9,878	13.8	67.0	117,521	16.0	55.0
33	40	9,189	12.8	79.8	119,663	16.2	71.3
34	43	9,878	13.8	93.6	140,427	19.1	90.3
35	20	4,594	6.4	100.0	71,120	9.7	100.0
36	0	0	0.0	100.0	0	0.0	100.0

312 71,674 fish

736,647 pounds

Ave. size = 30.0 inches
SE = 0.75

Ave. wt. = 10.3 pounds

* Size interval 15 contains fish measuring from 14.1 to 15,
16 contains fish from 15.1 to 16, etc...

Table 2.
Size distribution of striped bass sold during the 1990
Massachusetts fishery. Based on Dealer written transactions.

* TI (in.)	Sample	Total	%	Cumm. %	Wt. (lbs.)	%	Cumm. %
32	0	0	0.0	0.0	0	0.0	0.0
33	1	7	0.1	0.1	91	0.1	0.0
34	11	77	1.2	1.3	1,094	0.7	0.7
35	60	421	6.7	8.0	6,500	4.0	4.7
36	77	541	8.5	16.5	9,062	5.6	10.4
37	173	1,215	19.2	35.7	22,069	13.7	24.1
38	90	632	10.0	45.7	12,417	7.7	31.8
39	108	758	12.0	57.6	16,084	10.0	41.9
40	29	204	3.2	60.9	4,653	2.9	44.8
41	43	302	4.8	65.6	7,418	4.6	49.4
42	19	133	2.1	67.7	3,518	2.2	51.6
43	16	112	1.8	69.5	3,175	2.0	53.5
44	25	176	2.8	72.3	5,308	3.3	56.9
45	29	204	3.2	75.5	6,578	4.1	60.9
46	39	274	4.3	79.8	9,437	5.9	66.8
47	37	260	4.1	83.9	9,537	5.9	72.8
48	46	323	5.1	89.0	12,614	7.9	80.6
49	45	316	5.0	94.0	13,111	8.2	88.8
50	30	211	3.3	97.3	9,276	5.8	94.6
51	3	21	0.3	97.7	983	0.6	95.2
52	11	77	1.2	98.9	3,817	2.4	97.5
53	6	42	0.7	99.6	2,202	1.4	98.9
54	3	21	0.3	99.9	1,163	0.7	99.6
55	0	0	0.0	99.9	0	0.0	99.6
56	0	0	0.0	99.9	0	0.0	99.6
57	0	0	0.0	99.9	0	0.0	99.6
58	1	7	0.1	100.0	478	0.3	99.9
59	0	0	0.0	100.0	0	0.0	99.9
60	0	0	0.0	100.0	0	0.0	99.9

902 6,333 fish

160,588 pounds

Ave. size = 40.35 inches
SE = 0.17

Ave. wt. = 25.4 pounds

* Size interval 36 contains fish measuring from 35.1 to 36 inches.

Table 3.

Size distribution of striped bass harvested but not sold during the 1990 Massachusetts fishery. Based on fishermen seasonal catch reports.

TL (in.)	Sample	Total	%	Cumm. %	Wt. (lbs.)	%	Cumm. %
32	0	0	0.0	0.0	0	0.0	0.0
33	0	0	0.0	0.0	0	0.0	0.0
34	1	11	0.5	0.5	150	0.3	0.3
35	4	42	2.0	2.5	655	1.2	1.5
36	6	64	3.0	5.5	1,067	2.0	3.4
37	30	318	14.9	20.4	5,782	10.6	14.1
38	16	170	8.0	28.4	3,335	6.1	20.2
39	43	456	21.4	49.8	9,674	17.8	38.0
40	10	106	5.0	54.7	2,424	4.5	42.5
41	13	138	6.5	61.2	3,388	6.2	48.7
42	19	202	9.5	70.6	5,315	9.8	58.5
43	10	106	5.0	75.6	2,998	5.5	64.0
44	10	106	5.0	80.6	3,208	5.9	69.9
45	7	74	3.5	84.1	2,399	4.4	74.4
46	3	32	1.5	85.6	1,097	2.0	76.4
47	7	74	3.5	89.1	2,726	5.0	81.4
48	5	53	2.5	91.5	2,071	3.8	85.2
49	7	74	3.5	95.0	3,081	5.7	90.9
50	4	42	2.0	97.0	1,868	3.4	94.3
51	4	42	2.0	99.0	1,980	3.6	98.0
52	0	0	0.0	99.0	0	0.0	98.0
53	2	21	1.0	100.0	1,109	2.0	100.0
54	0	0	0.0	100.0	0	0.0	100.0
55	0	0	0.0	100.0	0	0.0	100.0
56	0	0	0.0	100.0	0	0.0	100.0
57	0	0	0.0	100.0	0	0.0	100.0
58	0	0	0.0	100.0	0	0.0	100.0
59	0	0	0.0	100.0	0	0.0	100.0
60	0	0	0.0	100.0	0	0.0	100.0

201 2,132 fish

54,327 pounds

Ave. size = 40.60 inches
SE = 0.29

Ave wt. = 25.5 pounds

Table 4.

Size distribution of legal size striped bass caught and released during the 1990 Massachusetts fishery. Based on fishermen's seasonal catch reports.

TL(in)	Sample	Total	%	Cumm. %	Wt. (lbs.)	%	Cumm. %
32	0	0	0.0	0.0	0	0.0	0.0
33	0	0	0.0	0.0	0	0.0	0.0
34	2	34	2.6	2.6	476	1.6	1.6
35	3	50	3.8	3.8	777	2.6	4.3
36	5	84	6.4	6.4	1,407	4.8	9.0
37	30	503	38.5	38.5	9,147	31.1	40.1
38	1	17	1.3	1.3	330	1.1	41.2
39	15	252	19.2	19.2	5,339	18.1	59.3
40	2	34	2.6	2.6	767	2.6	61.9
41	2	34	2.6	2.6	825	2.8	64.8
42	5	84	6.4	6.4	2,213	7.5	72.3
43	0	0	0.0	0.0	0	0.0	72.3
44	4	67	5.1	5.1	2,030	6.9	79.2
45	1	17	1.3	1.3	542	1.8	81.0
46	1	17	1.3	1.3	578	2.0	83.0
47	1	17	1.3	1.3	616	2.1	85.1
48	1	17	1.3	1.3	655	2.2	87.3
49	2	34	2.6	2.6	1,393	4.7	92.0
50	1	17	1.3	1.3	739	2.5	94.5
51	1	17	1.3	1.3	783	2.7	97.2
52	1	17	1.3	1.3	829	2.8	100.0
53	0	0	0.0	0.0	0	0.0	100.0
54	0	0	0.0	0.0	0	0.0	100.0
55	0	0	0.0	0.0	0	0.0	100.0
56	0	0	0.0	0.0	0	0.0	100.0
57	0	0	0.0	0.0	0	0.0	100.0
58	0	0	0.0	0.0	0	0.0	100.0
59	0	0	0.0	0.0	0	0.0	100.0
60	0	0	0.0	0.0	0	0.0	100.0

78 1,309 fish

29,447 pounds

Ave. size = 38.8 inches
SE = 0.10

Ave. wt. = 22.5 pounds

Table 5.
Estimated size distribution of the total striped bass catch during
the 1990 Massachusetts commercial fishery. Based on numbers of fish.

*TI (in.)	Sub-legal Released	Harvest Sold	Harvest Not Sold	Legal Size Released	Total	%	Cumm. %
16	689				689	0.8	0.8
17	230				230	0.3	1.1
18	230				230	0.3	1.4
19	230				230	0.3	1.7
20	1,378				1,378	1.7	3.4
21	230				230	0.3	3.7
22	1,838				1,838	2.3	5.9
23	1,608				1,608	2.0	7.9
24	2,527				2,527	3.1	11.0
25	1,378				1,378	1.7	12.7
26	3,216				3,216	3.9	16.6
27	3,446				3,446	4.2	20.9
28	6,662				6,662	8.2	29.1
29	2,297				2,297	2.8	31.9
30	6,662				6,662	8.2	40.1
31	5,513				5,513	6.8	46.8
32	9,878				9,878	12.1	58.9
33	9,189	7			9,196	11.3	70.2
34	9,878	77	11	34	10,000	12.3	82.5
35	4,594	421	42	50	5,109	6.3	88.8
36		541	64	84	688	0.8	89.6
37		1,215	318	503	2,036	2.5	92.1
38		632	170	17	818	1.0	93.1
39		758	456	252	1,466	1.8	94.9
40		204	106	34	343	0.4	95.4
41		302	138	34	473	0.6	95.9
42		133	202	84	419	0.5	96.5
43		112	106	0	218	0.3	96.7
44		176	106	67	349	0.4	97.2
45		204	74	17	295	0.4	97.5
46		274	32	17	322	0.4	97.9
47		260	74	17	351	0.4	98.3
48		323	53	17	393	0.5	98.8
49		316	74	34	424	0.5	99.3
50		211	42	17	270	0.3	99.7
51		21	42	17	80	0.1	99.8
52		77	0	17	94	0.1	99.9
53		42	21		63	0.1	100.0
54		21			21	0.0	100.0
55		0			0	0.0	100.0
56		0			0	0.0	100.0
57		0			0	0.0	100.0
58		7			7	0.0	100.0
Totals:	71,674	6,333	2,132	1,309	81,448		
Ave. size:	30.0	40.4	40.6	38.8	31.2		

* Size interval 16, contains fish measuring from 15.1 inches to 16.0 inches.

Table 6.

Estimated size distribution of the total striped bass catch during the 1990 Massachusetts commercial fishery. Based on weight of fish.

*TI (in.)	Sub-legal Released	Harvest Sold	Harvest Not Sold	Legal Size Released	Total	%	Cumm. %
16	1,071				1,071	0.1	0.1
17	427				427	0.0	0.2
18	504				504	0.1	0.2
19	591				591	0.1	0.3
20	4,124				4,124	0.4	0.7
21	793				793	0.1	0.8
22	7,275				7,275	0.7	1.5
23	7,253				7,253	0.7	2.2
24	12,915				12,915	1.3	3.6
25	7,942				7,942	0.8	4.4
26	20,793				20,793	2.1	6.5
27	24,890				24,890	2.5	9.0
28	53,544				53,544	5.5	14.5
29	20,468				20,468	2.1	16.6
30	65,572				65,572	6.7	23.3
31	59,753				59,753	6.1	29.3
32	117,521				117,521	12.0	41.3
33	119,663	91			119,754	12.2	53.5
34	140,427	1,094	150	476	142,147	14.5	68.0
35	71,120	6,500	655	777	79,052	8.1	76.1
36		9,062	1,067	1,407	11,536	1.2	77.3
37		22,069	5,782	9,147	36,998	3.8	81.0
38		12,417	3,335	330	16,082	1.6	82.7
39		16,084	9,674	5,339	31,097	3.2	85.8
40		4,653	2,424	767	7,843	0.8	86.6
41		7,418	3,388	825	11,631	1.2	87.8
42		3,518	5,315	2,213	11,047	1.1	89.0
43		3,175	2,998	0	6,173	0.6	89.6
44		5,308	3,208	2,030	10,546	1.1	90.7
45		6,578	2,399	542	9,519	1.0	91.6
46		9,437	1,097	578	11,112	1.1	92.8
47		9,537	2,726	616	12,879	1.3	94.1
48		12,614	2,071	655	15,341	1.6	95.6
49		13,111	3,081	1,393	17,586	1.8	97.4
50		9,276	1,868	739	11,883	1.2	98.6
51		983	1,980	783	3,747	0.4	99.0
52		3,817	0	829	4,646	0.5	99.5
53		2,202	1,109		3,311	0.3	99.8
54		1,163			1,163	0.1	100.0
55		0			0	0.0	100.0
56		0			0	0.0	100.0
57		0			0	0.0	100.0
58		478			478	0.0	100.0
Totals:	736,647	160,588	54,327	29,447	981,009		
Ave. wt.:	10.3	25.4	25.5	22.5	12.0		

* Size interval 16, contains fish measuring from 15.1 inches to 16.0 inches.

Table 7.
Estimated size distribution of the total striped bass catch during
the 1990 Massachusetts recreational fishery (NUMBERS OF FISH).

TL (in.)	Sub-legal Released	Legal Size Released	Harvested	Total	%	Cumm. %
16	4,115			4,115	0.9	0.9
17	1,372			1,372	0.3	1.2
18	1,372			1,372	0.3	1.5
19	1,372			1,372	0.3	1.8
20	8,229			8,229	1.8	3.6
21	1,372			1,372	0.3	3.9
22	10,972			10,972	2.4	6.4
23	9,601			9,601	2.1	8.5
24	15,087			15,087	3.3	11.8
25	8,229			8,229	1.8	13.6
26	19,202			19,202	4.2	17.9
27	20,573			20,573	4.5	22.4
28	39,775			39,775	8.8	31.2
29	13,716			13,716	3.0	34.2
30	39,775			39,775	8.8	43.0
31	32,917			32,917	7.3	50.2
32	58,977			58,977	13.0	63.2
33	54,862			54,862	12.1	75.3
34	58,977	286	71	59,333	13.1	88.4
35	27,431	429	283	28,143	6.2	94.6
36		714	425	1,139	0.3	94.9
37		4,286	2,126	6,412	1.4	96.3
38		143	1,134	1,276	0.3	96.6
39		2,143	3,047	5,190	1.1	97.7
40		286	709	994	0.2	97.9
41		286	921	1,207	0.3	98.2
42		714	1,346	2,061	0.5	98.7
43		0	709	709	0.2	98.8
44		571	709	1,280	0.3	99.1
45		143	496	639	0.1	99.2
46		143	213	355	0.1	99.3
47		143	496	639	0.1	99.5
48		143	354	497	0.1	99.6
49		286	496	782	0.2	99.7
50		143	283	426	0.1	99.8
51		143	283	426	0.1	99.9
52		143	0	143	0.0	100.0
53			142	142	0.0	100.0
54				0	0.0	100.0
55				0	0.0	100.0
56				0	0.0	100.0
57				0	0.0	100.0
58				0	0.0	100.0
Totals:	427,924	11,144	14,241	453,309		

Table 8.

Estimated size distribution of the total striped bass catch during
the 1990 Massachusetts recreational fishery (WEIGHT OF FISH).

TL (in.)	Sub-legal Released	Legal Size Released	Harvested	Total	%	Cumm. %
16	5,822			5,822	0.1	0.1
17	2,332			2,332	0.0	0.2
18	2,772			2,772	0.1	0.2
19	3,263			3,263	0.1	0.3
20	22,849			22,849	0.5	0.8
21	4,411			4,411	0.1	0.9
22	40,582			40,582	0.8	1.7
23	40,582			40,582	0.8	2.6
24	72,459			72,459	1.5	4.1
25	44,669			44,669	0.9	5.0
26	117,222			117,222	2.4	7.5
27	140,618			140,618	2.9	10.4
28	303,109			303,109	6.3	16.7
29	116,082			116,082	2.4	19.2
30	372,526			372,526	7.8	26.9
31	340,015			340,015	7.1	34.1
32	669,747			669,747	14.0	48.0
33	682,925			682,925	14.3	62.3
34	802,498	3,888	964	807,350	16.9	79.2
35	406,941	6,359	4,204	417,504	8.7	87.9
36		11,526	6,859	18,384	0.4	88.3
37		75,033	37,209	112,242	2.3	90.6
38		2,708	21,485	24,193	0.5	91.2
39		43,882	62,382	106,264	2.2	93.4
40		6,309	15,643	21,951	0.5	93.8
41		6,790	21,885	28,675	0.6	94.4
42		18,235	34,362	52,597	1.1	95.5
43		0	19,396	19,396	0.4	95.9
44		16,751	20,767	37,518	0.8	96.7
45		4,477	15,541	20,018	0.4	97.1
46		4,779	7,110	11,889	0.2	97.4
47		5,094	17,684	22,778	0.5	97.9
48		5,423	13,446	18,869	0.4	98.3
49		11,530	20,013	31,543	0.7	98.9
50		6,121	12,142	18,264	0.4	99.3
51		6,492	12,877	19,369	0.4	99.7
52		6,877	0	6,877	0.1	99.8
53			7,217	7,217	0.2	100.0
54				0	0.0	100.0
55				0	0.0	100.0
56				0	0.0	100.0
57				0	0.0	100.0
58				0	0.0	100.0
Totals:	4,191,424	242,272	351,186	4,784,882 pounds		

Table 9.
Estimated size distribution of striped bass losses in the 1990
Massachusetts commercial fishery (NUMBERS OF FISH).

TI (in.)	Sub-legal (Hook-Release & Poaching)	Harvest Sold	Harvest Not Sold	Legal Size (Hook-Release)	Total	%	Cumm. %
16	141				141	0.6	0.6
17	47				47	0.2	0.8
18	47				47	0.2	1.0
19	47				47	0.2	1.2
20	281				281	1.2	2.4
21	47				47	0.2	2.6
22	375				375	1.6	4.2
23	328				328	1.4	5.6
24	515				515	2.2	7.8
25	281				281	1.2	9.0
26	656				656	2.8	11.9
27	703				703	3.0	14.9
28	1,358				1,358	5.8	20.7
29	468				468	2.0	22.7
30	1,358				1,358	5.8	28.5
31	1,124				1,124	4.8	33.4
32	2,014				2,014	8.6	42.0
33	1,873	7			1,880	8.1	50.1
34	2,014	77	11	6	2,108	9.0	59.1
35	937	421	42	9	1,409	6.0	65.2
36		541	64	15	619	2.7	67.8
37		1,215	318	88	1,621	7.0	74.8
38		632	170	3	805	3.5	78.2
39		758	456	44	1,258	5.4	83.6
40		204	106	6	316	1.4	85.0
41		302	138	6	446	1.9	86.9
42		133	202	15	350	1.5	88.4
43		112	106	0	218	0.9	89.3
44		176	106	12	293	1.3	90.6
45		204	74	3	281	1.2	91.8
46		274	32	3	309	1.3	93.1
47		260	74	3	337	1.4	94.6
48		323	53	3	379	1.6	96.2
49		316	74	6	396	1.7	97.9
50		211	42	3	256	1.1	99.0
51		21	42	3	66	0.3	99.3
52		77	0	3	80	0.3	99.6
53		42	21		63	0.3	99.9
54		21			21	0.1	100.0
55		0			0	0.0	100.0
56		0			0	0.0	100.0
57		0			0	0.0	100.0
58		7			7	0.0	100.0
Totals:	14,613	6,333	2,132	229	23,307		
Percent:	62.7	27.2	9.1	1.0			

Table 10.
Estimated size distribution of striped bass losses in the 1990
Massachusetts commercial fishery (WEIGHT OF FISH).

TL (in.)	Sub-legal (Hook-Release & Poaching)	Harvest Sold	Harvest Not Sold	Legal Size (Hook-Release)	Total	%	Cumm. %
16	199				199	0.1	0.1
17	80				80	0.0	0.1
18	95				95	0.0	0.1
19	111				111	0.0	0.1
20	780				780	0.2	0.4
21	151				151	0.0	0.4
22	1,386				1,386	0.4	0.8
23	1,386				1,386	0.4	1.2
24	2,474				2,474	0.7	1.9
25	1,525				1,525	0.4	2.3
26	4,003				4,003	1.1	3.4
27	4,802				4,802	1.3	4.8
28	10,351				10,351	2.9	7.7
29	3,964				3,964	1.1	8.8
30	12,721				12,721	3.6	12.4
31	11,611				11,611	3.3	15.6
32	22,871				22,871	6.4	22.0
33	23,321	87			23,408	6.6	28.6
34	27,404	1,051	144	80	28,679	8.1	36.7
35	13,896	6,249	629	131	20,906	5.9	42.5
36		8,722	1,027	237	9,986	2.8	45.3
37		21,263	5,571	1,542	28,376	8.0	53.3
38		11,976	3,216	56	15,248	4.3	57.6
39		15,526	9,339	902	25,767	7.2	64.8
40		4,495	2,342	130	6,967	2.0	66.8
41		7,174	3,276	140	10,589	3.0	69.8
42		3,405	5,144	375	8,924	2.5	72.3
43		3,075	2,904	0	5,979	1.7	73.9
44		5,145	3,109	344	8,598	2.4	76.4
45		6,380	2,327	92	8,799	2.5	78.8
46		9,159	1,064	98	10,322	2.9	81.7
47		9,263	2,647	105	12,015	3.4	85.1
48		12,259	2,013	111	14,383	4.0	89.1
49		12,749	2,996	237	15,982	4.5	93.6
50		9,025	1,818	126	10,968	3.1	96.7
51		957	1,928	133	3,018	0.8	97.6
52		3,717	0	141	3,859	1.1	98.6
53		2,146	1,080		3,226	0.9	99.6
54		1,134			1,134	0.3	99.9
55		0			0	0.0	99.9
56		0			0	0.0	99.9
57		0			0	0.0	99.9
58		467			467	0.1	100.0
Totals:	143,131	155,426	52,576	4,978	356,111		
Percent:	40.2	43.6	14.8	1.4			

Table 11.
Estimated size distribution of striped bass losses in the 1990
Massachusetts recreational fishery (NUMBERS OF FISH).

TL (in.)	Sub-legal (Hook-Release & Poaching)	Legal Size (Hook-Release)	Harvested	Total	%	Cumm. %
16	1,193			1,193	0.9	0.9
17	398			398	0.3	1.1
18	398			398	0.3	1.4
19	398			398	0.3	1.7
20	2,387			2,387	1.7	3.4
21	398			398	0.3	3.7
22	3,182			3,182	2.3	6.0
23	2,784			2,784	2.0	7.9
24	4,375			4,375	3.1	11.1
25	2,387			2,387	1.7	12.8
26	5,569			5,569	4.0	16.7
27	5,966			5,966	4.3	21.0
28	11,535			11,535	8.2	29.2
29	3,978			3,978	2.8	32.0
30	11,535			11,535	8.2	40.3
31	9,546			9,546	6.8	47.1
32	17,103			17,103	12.2	59.3
33	15,910			15,910	11.3	70.6
34	17,103	50	71	17,224	12.3	82.9
35	7,955	75	283	8,313	5.9	88.8
36		125	425	550	0.4	89.2
37		750	2,126	2,876	2.0	91.2
38		25	1,134	1,159	0.8	92.1
39		375	3,047	3,422	2.4	94.5
40		50	709	759	0.5	95.0
41		50	921	971	0.7	95.7
42		125	1,346	1,471	1.0	96.8
43		0	709	709	0.5	97.3
44		100	709	809	0.6	97.9
45		25	496	521	0.4	98.2
46		25	213	238	0.2	98.4
47		25	496	521	0.4	98.8
48		25	354	379	0.3	99.1
49		50	496	546	0.4	99.4
50		25	283	308	0.2	99.7
51		25	283	308	0.2	99.9
52		25	0	25	0.0	99.9
53			142	142	0.1	100.0
54				0	0.0	100.0
55				0	0.0	100.0
56				0	0.0	100.0
57				0	0.0	100.0
58				0	0.0	100.0
Totals:	124,098	1,950	14,241	140,289		
Percent:	88.5	6.6	48.3			

Table 12.
Estimated size distribution of striped bass losses in the 1990
Massachusetts recreational fishery (WEIGHT OF FISH).

TL (in.)	Sub-legal (Hook-Release & Poaching)	Legal Size (Hook-Release)	Harvested	Total	%	Cumm. %
16	1,688			1,688	0.1	0.1
17	676			676	0.0	0.1
18	804			804	0.0	0.2
19	946			946	0.1	0.3
20	6,626			6,626	0.4	0.7
21	1,279			1,279	0.1	0.7
22	11,769			11,769	0.7	1.5
23	11,769			11,769	0.7	2.2
24	21,013			21,013	1.3	3.5
25	12,954			12,954	0.8	4.3
26	33,995			33,995	2.1	6.4
27	40,779			40,779	2.5	9.0
28	87,902			87,902	5.5	14.4
29	33,664			33,664	2.1	16.5
30	108,033			108,033	6.7	23.2
31	98,604			98,604	6.1	29.4
32	194,227			194,227	12.1	41.4
33	198,048			198,048	12.3	53.7
34	232,725	680	964	234,369	14.6	68.3
35	118,013	1,113	4,204	123,330	7.7	76.0
36		2,017	6,859	8,875	0.6	76.5
37		13,129	37,209	50,339	3.1	79.7
38		474	21,485	21,959	1.4	81.0
39		7,679	62,382	70,061	4.4	85.4
40		1,104	15,643	16,746	1.0	86.4
41		1,188	21,885	23,073	1.4	87.8
42		3,191	34,362	37,553	2.3	90.2
43		0	19,396	19,396	1.2	91.4
44		2,931	20,767	23,698	1.5	92.9
45		783	15,541	16,324	1.0	93.9
46		836	7,110	7,946	0.5	94.4
47		891	17,684	18,575	1.2	95.5
48		949	13,446	14,395	0.9	96.4
49		2,018	20,013	22,030	1.4	97.8
50		1,071	12,142	13,214	0.8	98.6
51		1,136	12,877	14,013	0.9	99.5
52		1,203	0	1,203	0.1	99.6
53			7,217	7,217	0.4	100.0
54				0	0.0	100.0
55				0	0.0	100.0
56				0	0.0	100.0
57				0	0.0	100.0
58				0	0.0	100.0
Totals:	1,215,513	42,393	351,186	1,609,093		
Percent:	75.5	2.6	21.8			

Table 13.

The estimated loss of striped bass in number and pounds as a result of fishing in Massachusetts waters during 1990.

Fishery	Numbers	Percentage	Pounds	Percentage
Commercial 1\Harvest	6,300	3.9	148,000	7.6
Commercial 2\Hook-Release	12,400	7.6	124,300	6.3
Commercial Poaching	2,400	1.5	23,900	1.2
Recreational 3\Harvest	16,400	10.0	403,800	20.6
Recreational 4\Hook-Release	70,900	43.3	717,700	36.7
Recreational Poaching	55,200	33.7	540,200	27.6
Totals:	163,600		1,957,900	

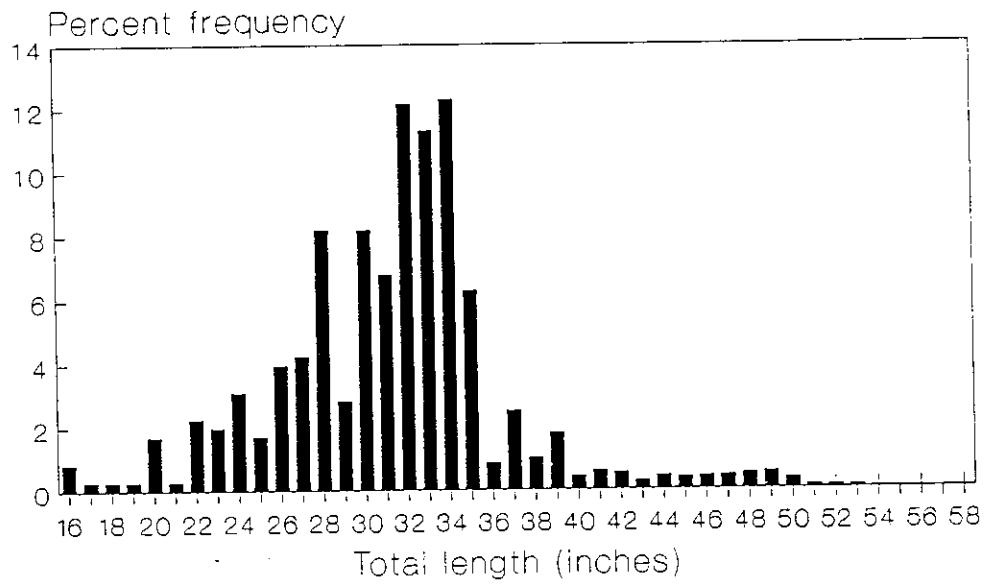
1\ Based on written transcripts provided by seafood dealers.

2\ Includes 83% of the total lost to hook-release and poaching on sub-legals, since $(h) = 0.175$ and $(p) = 0.035$, and 100% of the hook-release loss on legal.

3\ Includes a recreational harvest reported by commercially licensed fishermen.

4\ Includes 56% of the total lost to hook-release and poaching on sub-legals, since $(h) = 0.175$ and $(p) = 0.14$, and 100% of the hook-release loss on legal.

Figure 1. Estimated size distribution of the total striped bass catch during the 1990 Massachusetts commercial fishery.



Based on numbers of fish.